

AGEDI | THE ABU DHABI GLOBAL ENVIRONMENTAL DATA INITIATIVE

NATIONAL BLUE CARBON



Foreword

Dr. Rashid Ahmed Bin Fahad,
Minister of Environment and Water



Today the world faces multiple global challenges such as drought, population growth, economic development and the effects of climate change. All these have significant effects on our natural resources and ecosystems.

The UAE has a number of wonderful and diverse coastal ecosystems, such as mangrove forests, saltwater marshes and seagrass meadows. These ecosystems provide ecological services, such as the ability to filter pollution, provide fish nurseries, buffer shorelines against storms, and enhance eco-tourism with significant cultural and social values. Moreover, these ecosystems are able to sequester and store carbon, and are therefore known as Blue Carbon ecosystems.

The National Blue Carbon project aims to understand the carbon storage of these ecosystems, providing a powerful tool to develop comprehensive policies to support the principles of integrated management of ecosystems, and to strengthen institutional and legislative frameworks.

This vital initiative is aligned with the UAE Vision 2021 and supports achieving the objectives of the UAE Green Growth, the National Biodiversity and the National Coastal and Marine Sustainability strategies.

My sincere appreciation goes out to all the stakeholders that were dedicated to making this initiative successful, and to reflecting the UAE's commitment to global efforts supporting biodiversity for sustainable development.

“The Blue Carbon Initiative is a significant tool to mitigate climate change by enhancing our coastal ecosystems”

Preface



Razan Khalifa Al Mubarak
Secretary General,
Environment Agency - Abu Dhabi

Our coastlines have been a source of nutrition, trade, income and an array of other services for decades, and they continue to be an extremely important part and parcel of the cultural identity of the Emirate of Abu Dhabi, and indeed the UAE. Coastal ecosystems, and their role in our heritage and tradition, must be preserved.

Phase I of our Blue Carbon Project – a demonstration project that focused on the Emirate of Abu Dhabi – was born out of this natural affinity to the sea. Completed in 2013, Phase I not only provided a true and detailed understanding of carbon dioxide sequestration and storage in the Emirate, but also demonstrated the power of data collaboration, and its use in decision-making, capacity-building, policy-making, and urban planning. As a result, the values of Blue Carbon and related ecosystem services were incorporated into the coastal and marine management policies of the Abu Dhabi Emirate.

The invaluable outcomes of the Abu Dhabi Blue Carbon Demonstration Project led to the expansion of the science across to the UAE's Northern and Eastern regions of the UAE: the National Blue Carbon Project. In addition to providing a baseline assessment of carbon stocks and sequestration in the UAE, the Project has also provided a geographic assessment that mapped mangroves and estimated our total Blue Carbon stocks, and also helped build capacity on-the-ground in this area of study.

By delivering an enhanced understanding of what and where our natural capital is, we ensure that we can best protect and capitalise on it. This collaborative project delivers just that, supporting an existing commitment to making informed decisions, and facilitating an on-going shift towards an environmentally sustainable future for the UAE.



“The Blue Carbon ecosystems are an extremely important part and parcel of the cultural identity of the Emirate of Abu Dhabi and indeed the UAE.”

Introduction



Blue Carbon refers to coastal vegetation, which studies have shown can sequester carbon far more effectively than terrestrial forests. As such, conserving these important ecosystems is one of the most promising new ways to reduce atmospheric carbon dioxide, and limit global climate change. Blue Carbon ecosystems can be found all over the world, and in the United Arab Emirates (UAE), are made up of mangrove forests, seagrass meadows and saltwater marshlands, which serve as carbon sinks.

When these ecosystems are destroyed, large amounts of buried carbon can be released into the atmosphere, contributing to global warming. In addition to their climate related benefits, Blue Carbon ecosystems provide highly valuable ecosystem services to coastal communities – they protect shorelines, provide nursery grounds for fish and habitats for a wide range of terrestrial and aquatic species, and they support coastal tourism. They also have significant cultural and social values.

In late 2012, the Abu Dhabi Blue Carbon Demonstration Project (Phase I of the Blue Carbon Project) was launched to improve our understanding of coastal ecosystems in the Abu Dhabi Emirate, and how they help to sequester carbon and provide valuable services to coastal communities. On a local level, it also enhanced local capacity to measure and monitor carbon; internationally, it helped guide other Blue Carbon initiatives to develop the science and data management tools, creating a sophisticated methodology for continuing the preservation of blue carbon habitats. The Project's findings have since been used in policy-making for sustainable preservation of these environments, particularly in Abu Dhabi's coastal ecosystem management and climate change mitigation and development plans.

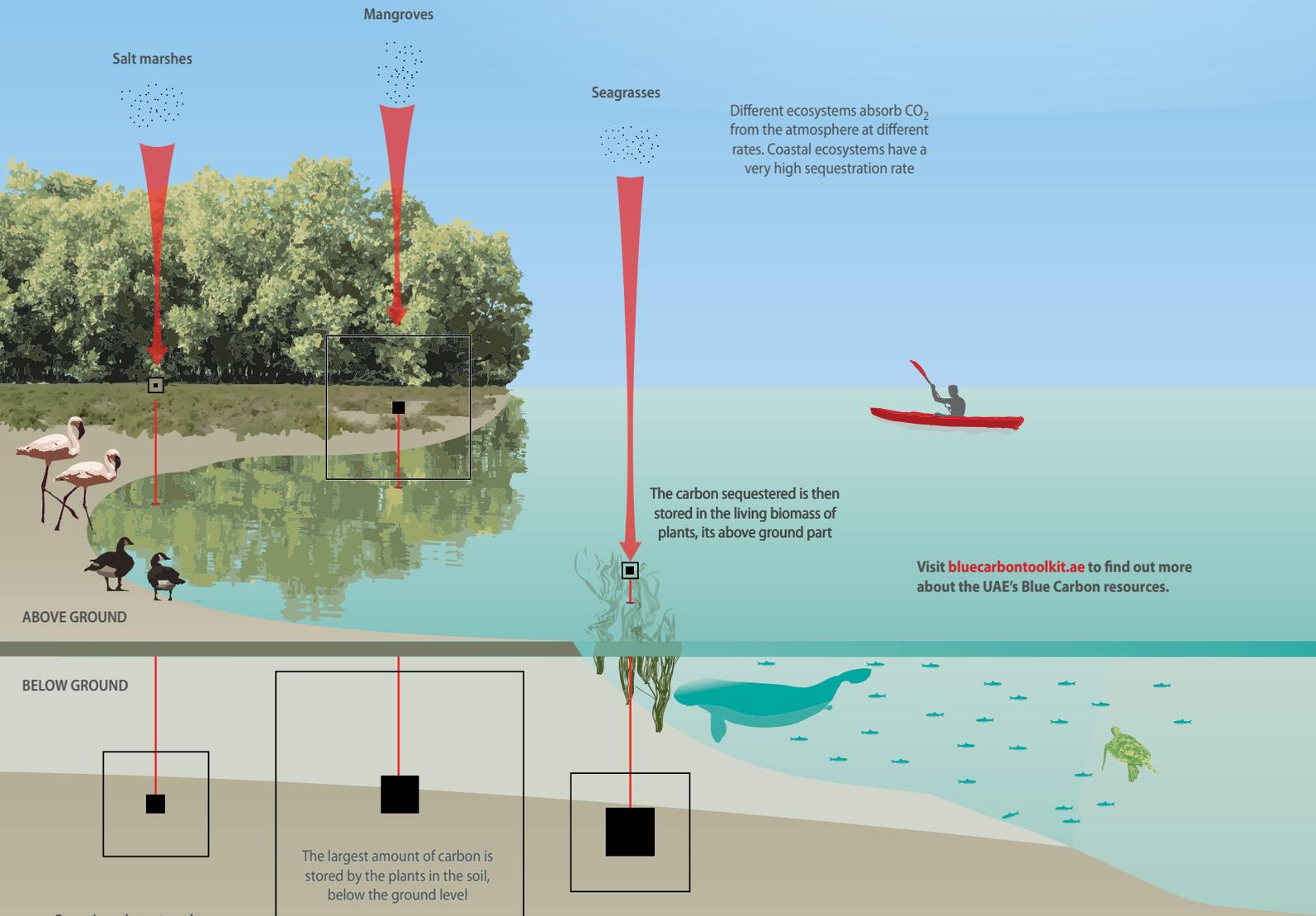
The success of Phase I saw the launch of Phase II, a National Blue Carbon Project that extended the baseline assessment of the total carbon stocks of mangroves to the Northern and Eastern Emirates. This effort included field surveys specifically quantify the carbon of mangroves ecosystems; capacity building for those interested in learning about Blue Carbon and mangrove ecology sampling approaches; and extensive laboratory and computer analysis to determine carbon stocks in a scientifically defensible manner.

The Project is a collaborative initiative managed and facilitated by a partnership between the UAE Ministry of Environment and Water (MOEW) and AGEDI, implemented in collaboration with Environment Agency– Abu Dhabi (EAD) and the other local competent authorities of each Emirate including Dubai Municipality, Environment and Protected Areas Authority of Sharjah, Environment Protection and Development Authority of Ras Al Khaimah, Umm Al Quwain Municipality, and Municipality and Planning Department Ajman.

The Principle Investigators of this study are members of the International Blue Carbon Scientific Working Group: Dr. Stephen Crooks and Dr. Boone Kauffman. Hosted by Conservation International, the International Union for Conservation of Nature (IUCN), and the Intergovernmental Oceanographic Commission (IOC), this working group of scientists assists in the building of capacity for the understanding of carbon cycling by coastal marine ecosystems. The Science Working Group runs in parallel with the International Blue Carbon Policy Working Group under the Blue Carbon Initiative.

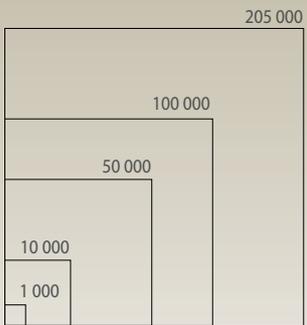


Blue Carbon ecosystems provide a highly valuable service by sequestering and storing atmospheric carbon



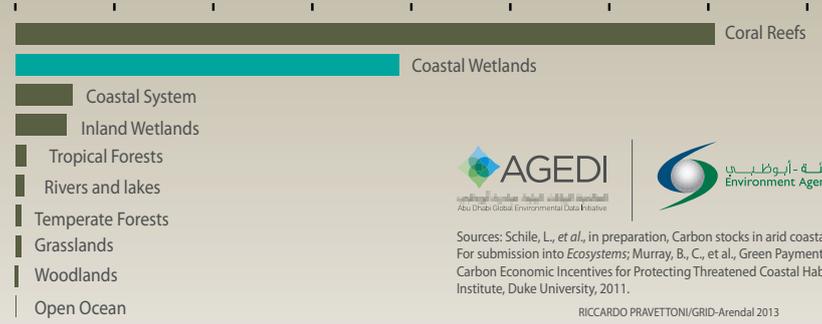
Organic carbon stored
Tonnes of carbon per km²

Higher estimate
Lower estimate



Ecosystem service value

Thousand US Dollars per hectare per year



Sources: Schile, L., et al., in preparation, Carbon stocks in arid coastal environments. For submission into Ecosystems; Murray, B., C., et al., Green Payments for Blue Carbon Economic Incentives for Protecting Threatened Coastal Habitats, Nikolas Institute, Duke University, 2011.



Field work site - Al Khor

- A geographic assessment that maps mangroves, based on existing data available, and provides an estimate of the Northern and Eastern Emirates' total blue carbon stocks
- A capacity-building component, including the provision of training on marine and coastal ecosystem Services, with a focus on blue carbon

Standard field and analytical approaches were used to enable comparison with a growing global dataset on carbon stocks within coastal ecosystems. The investigation provided a baseline assessment of carbon stocks at 10 mangroves and one algal flat of the Northern and Eastern Emirates – perhaps the largest carbon stocks of the UAE. This extended to a total of 57 sites sampled in the UAE, representing natural mangroves, planted mangroves, salt marshes, seagrass meadows, and algal mats. These new data points in the Northern and Eastern Emirates form an important part of the overall national Blue Carbon account for the UAE.

Carbon stocks of existing natural intertidal ecosystems mangroves were sampled from sites that were representative of the Northern and Eastern Emirates. This included sites both in the Sea of Oman and the Arabian Gulf. Sites were selected to represent a range of environmental settings (e.g. islands, mainland coast line, and sheltered estuaries). The sites that were selected for survey were in consultation with local environmental agencies using the following criteria:

1. Sample across as much of the study area as logistically possible
2. Sample areas where the mangrove ecosystem has a large spatial extent

Objectives

The goals of the project were to:

1. Assess the feasibility of coastal Blue Carbon as a conservation and management tool and its potential for climate change mitigation
2. Provide implementable recommendations for coastal marine conservation and management that maximises sequestration of carbon and avoids emissions in coastal systems
3. Establish a network of demonstration projects to quantify carbon stocks and fluxes, test protocols for monitoring, reporting and verification
4. Promote and support scientific research on carbon cycling by coastal Blue Carbon ecosystems

Project Overview

For this national study, the project was engaged to quantify carbon stocks in Blue Carbon ecosystems within Khor (lagoons) along the coast of Dubai, Sharjah, Ajman, Umm Al-Quwain and Ras Al Khaimah. The team worked closely with AGEDI, EAD, MoEW, and the competent authorities of each Emirate to select, access, and sample field locations.

Activities included:

- A baseline assessment of carbon stocks and sequestration of the mangroves of the Northern and Eastern Emirates

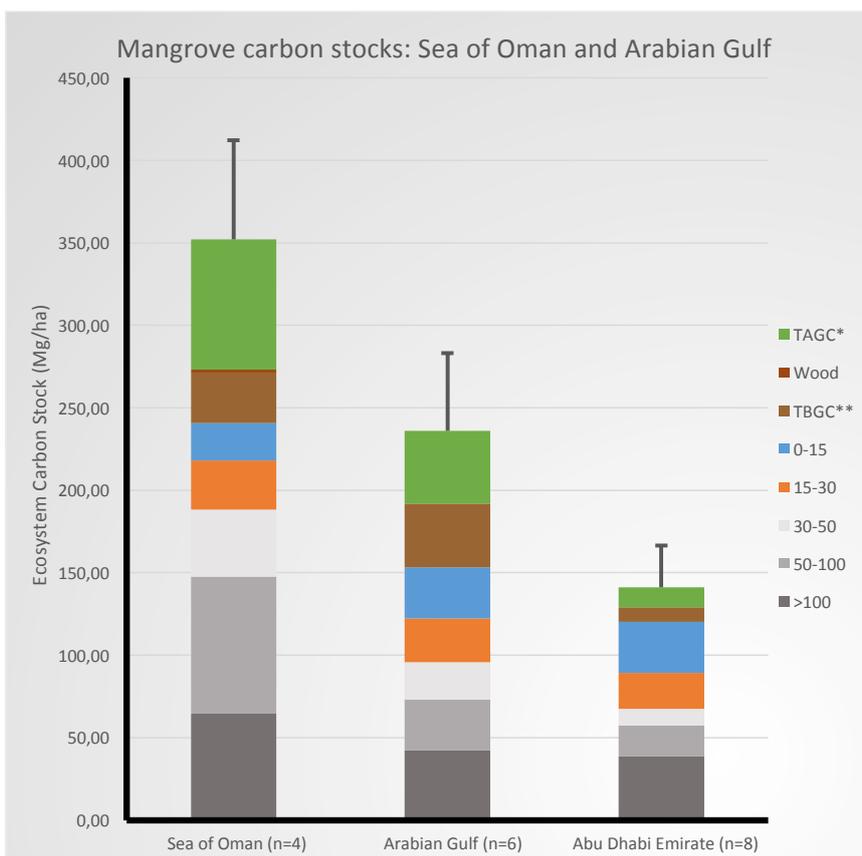


Field work site - Khor Al Rams



Results

- As of 2015, the carbon stocks of 18 mangroves of the UAE have been quantified. This includes four in the Sea of Oman (Kalba) of Sharjah Emirate, six in the Arabian Gulf of the Northern Emirates, and eight in the Abu Dhabi Emirate
- The data suggest that mangroves of the Northern Emirates are generally larger than those of Abu Dhabi Emirate – but this varies:
 - The mean ecosystem carbon stock of the mangroves of the three areas are 389, 229, and 140 Mg C/ha (mega grams of carbon per hectare), respectively
 - The mean ecosystem carbon stock of all studied sites combined was 293.15 Mg C/ha. The carbon stocks of the Northern and Eastern Emirates were significantly different than the mangroves sampled in Abu Dhabi
- The greatest differences among sites are in the plant carbon pools and in deeper soil layers:
 - There were few differences in the carbon pools of soils 0-30 cm in depth, however, the plant carbon stocks of the Northern and Eastern Emirates greatly exceeded that of the Abu Dhabi mangroves (i.e. >80 Mg C/ha for the Northern and Eastern Emirates, but <21 Mg C/ha for the sampled Abu Dhabi mangroves)
 - Additional differences were found at greater soil depths; for example, the mean carbon pools of soils >50 cm in depth was 57 Mg C/ha for the Abu Dhabi mangroves but 185 Mg C/ha at the Sharjah sites
- The carbon stocks of hyper-arid and hyper-saline mangroves of the UAE are at the lower end of carbon stocks, but have some similarities with other parts of the world:
 - Globally mangrove carbon stocks have been reported to be about 1000 Mg C/ha
 - The size of the UAE's carbon stocks of mangroves of sandy substrates is similar to what has been reported for Madagascar
 - The very high carbon stocks measured for Kalba South (667 Mg/ha) are similar to productive mangroves in many parts of the world
 - These Blue Carbon ecosystems hold the largest carbon stocks found across the Arabian Peninsula



Note: Vertical bars represent one standard error.

Total ecosystem carbon stocks (Mg/ha) of sampled mangroves separated into those of the Sea of Oman, the Arabian Gulf (Northern and Eastern Emirates) and those of Abu Dhabi Emirate, UAE.

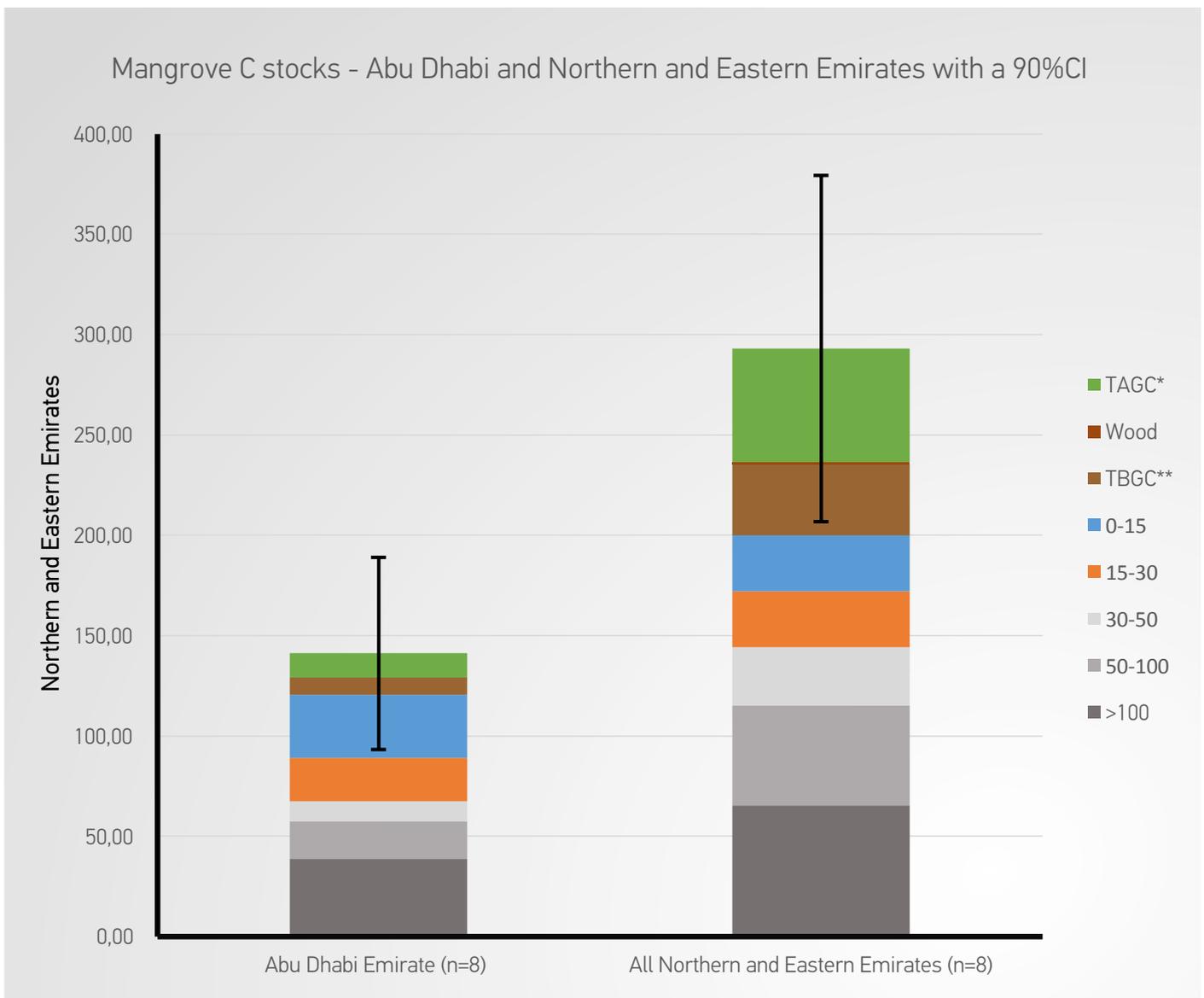
The ecosystem carbon stocks (Mg/ha) of the mangroves of the UAE separated into those of the Sea of Oman (Kalba site), the Northern and Eastern on the Arabian Gulf, and those of the Abu Dhabi Emirate on the Arabian Gulf.

*TAGC = Total Above Ground Carbon

**TBGC = Total Below Ground Carbon

Site	Soils by depth (cm)					Plant components			Total carbon (C) stock	Standard Errors (SE)
	0-15	15-30	30-50	50-100	>100	Above ground	Below ground	Wood		
Sea of Oman (n=4)	22.87	29.75	40.39	83.15	101.92	78.93	30.51	1.79	389.30	95.52
Arabian Gulf (n=6)	31.44	26.23	21.57	27.52	41.11	42.16	38.97	0.00	229.06	50.86
All UAE (n=10)	28.01	27.63	29.10	49.77	65.43	56.87	35.59	0.71	293.15	47.05
(n=8)	31.22	21.69	10.07	18.76	38.64	12.02	8.71	0.00	140.48	25.33

The ecosystem carbon stocks (Mg/ha) of the mangroves of the UAE separated into those of the Sea of Oman (Kalba site), the Northern and Eastern on the Arabian Gulf, and those of the Abu Dhabi Emirate on the Arabian Gulf.



Note: The carbon stocks are significantly different at the $P < 0.10$ level. Vertical bars here represent the 90% confidence interval for mangroves sampled in these two regions.

Figure 1: Ecosystem Carbon stocks of the mangroves of the Abu Dhabi Emirate and the Northern and Eastern Emirates.



Moving Forward – Recommendations

Conservation measures to protect these high value ecosystems and restoration measures to recover degraded sites will bring benefits for the environment and for the people of the Emirates.

As such, the National Blue Carbon Project garnered the following recommendations for these crucial ecosystems:

- Environmental analyses (field and remote sensing) are needed to determine ongoing losses and predict future mangrove distribution to develop conservation/preservation plans
- All sites sampled offer a unique biodiversity providing the people of the UAE with a number of important ecosystem services. These are among the most magnificent natural ecosystems of the UAE. Conservation of these globally unique, important and valuable ecosystems is warranted
- In terms of conservation, restoration and preservation of the mangroves of the UAE, land managers and planners should consider the watershed level effects of ground and surface water disruption, influences on tidal patterns and pollution effects
- Because of the unique values and ecosystem services provided by mangroves, a moratorium on any further loss is recommended

The following observations and recommendations can be highlighted from the Project:

- In the case of unique mangrove systems that enjoy deep and highly carbon-rich soil and significant biodiversity, conservation efforts have resulted in ongoing recovery of both mangroves and other species (i.e. shellfish and fish resources) of the ecosystem ➔ Further conservation and public education opportunities are essential, as is careful consideration of any development opportunities or existing projects in surrounding areas
- For sites whose health has already been negatively impacted due to human activity ➔ Investigation into restoration opportunities is warranted
- Some at-risk sites situated close to population centres have the potential to serve as sources of both education and recreation ➔ Greater exposure is recommended to enhance public awareness about the importance and value of these ecosystems via education programmes and boardwalk accessibility
- Truly unique sites were identified, boasting rich and diverse ecologies and in close proximity to desert landscapes ➔ Such sites should be considered for high level conservation to protect their integrity



FOR MORE INFORMATION

For more information or to view the full technical report,
visit www.AGEDI.ae , or contact: BlueCarbon-EcosystemServices@ead.ae





an initiative of



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